USGS

Sound Waves Coastal and Marine Research News from Across the USGS

http://soundwaves.usgs.gov/

Fieldwork

Juvenile Surf Smelt and Sand Lance in Central Puget Sound, Washington—Links in a Complex Food Web

By Theresa L. Liedtke and Collin D. Smith

U.S. Geological Survey (USGS) scientists have been conducting surveys for juvenile surf smelt (*Hypomesus pretiosus*) and sand lance (*Ammodytes hexapterus*) in Washington's Puget Sound—a large estuarine system adjacent to a robust metropolitan area. Surf smelt and sand lance are two species of forage fish in this region that provide a key link in the marine food web between zooplankton (tiny aquatic animals) near the bottom of the food web and larger fish, seabirds, and marine mammals near the top of the food web. In Puget Sound, these forage fish are consumed by such economically and socially valuable predators as salmon, killer whales, and many marine birds. The surveys, conducted by scientists from the USGS Western Fisheries Research Center, Columbia River Research Laboratory (**http://wfrc.usgs.gov/fieldstations/columbia/**), are part of the Coastal Habitats in Puget Sound (CHIPS) program (**http://puget.usgs.gov/**).

Surf smelt and sand lance spawn on the upper intertidal areas of beaches in Puget Sound. As their eggs develop and they transform into juvenile fish, they reside near the beach for an unknown period of time. The movements and distribution of these juvenile fish after the spawning period are poorly understood. We investigated the use of nearshore habitats by juvenile stages of surf smelt and sand lance because nearshore areas are commonly used as nursery and rearing grounds for other species.

USGS crew members (left to right) ***Theresa "Marty" Liedtke, Lisa Gee, Ryan Tomka,*** *and* ***Collin Smith*** *hauling a sampling net over an eelgrass bed on Bainbridge Island, Washington. USGS photograph by* ***David Ayers****.*

*Juvenile sand lance (*Ammodytes hexapterus*) (top) and surf smelt (*Hypomesus pretiosus*) (bottom) collected on Bainbridge Island, Washington. Scale is in inches. USGS photograph by* ***David Ayers****.*

Our primary goal was to investigate the possible use of eelgrass (*Zostera marina*) habitats by the juvenile life stages of these forage fish by comparing their abundance in eelgrass areas with their abundance in areas without eelgrass. Eelgrass is a valued ecosystem component that provides cover and forage opportunities for a wide variety of species within Puget Sound. We hypothesized that juvenile forage fish may preferentially select eelgrass areas over bare habitats. A secondary question that we investigated was the influence of open shorelines versus embayments on the presence of juvenile forage fish. Small embayments—which are in decline in Puget Sound owing to the building of

(Forage Fish continued on page 2)

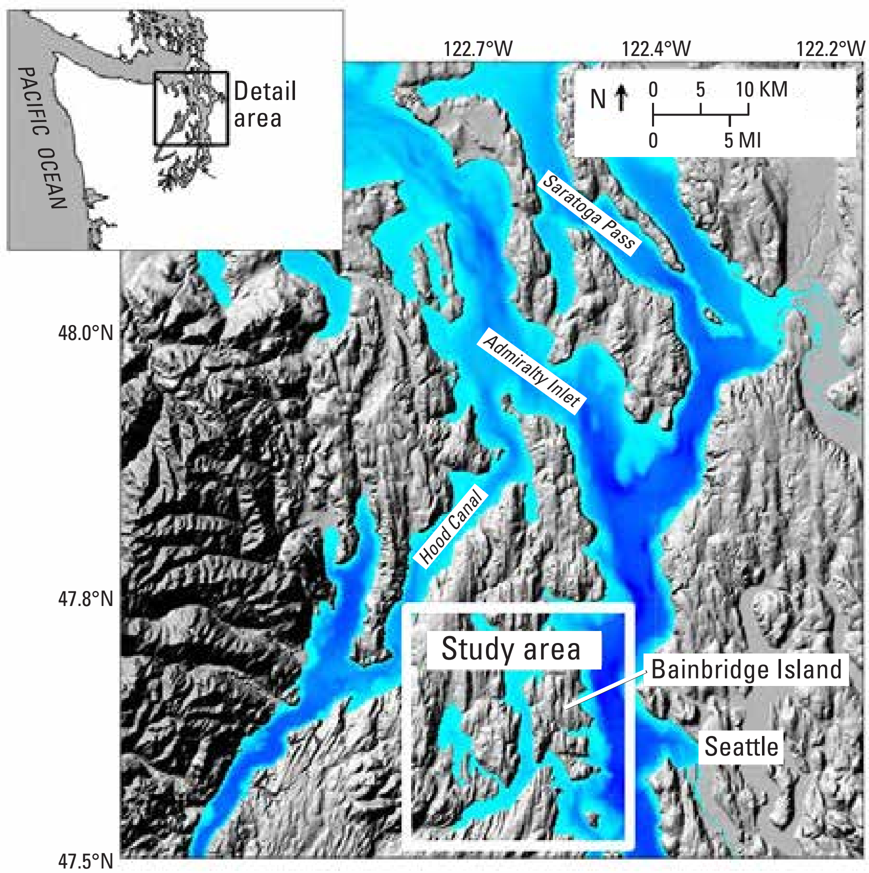
(Forage Fish continued from page 1)

roads and other shoreline development, such as housing and marinas—are valuable habitats for juvenile salmon. We hypothesized that embayments might also be an important habitat for forage fish, which are known to school with juvenile salmon. Combining these questions, we selected study sites in central Puget Sound that are either in embayments or on open shorelines, with or without eelgrass. At each study site, our objectives were to (1) assess the relative abundance of forage fish, (2) describe the extent and characteristics of eelgrass beds (if present), and (3) collect and identify prey items found in the nearshore and in dissected juvenile forage fish to evaluate food-web linkages.

Surveys for juvenile surf smelt and sand lance were conducted during May and June 2012 near Bainbridge Island, Washington, in central Puget Sound (see map). We captured, counted, and released more than 2,500 juvenile surf smelt and 59,000 juvenile sand lance. Our preliminary observations indicate that sand lance are most abundant in areas without eelgrass and that surf smelt have similar abundance in eelgrass and non-eelgrass areas. Both species appear to prefer embayments to open shorelines. Sand lance were caught infrequently but in very high abundance. Surf smelt, on the other hand, appeared to be more broadly distributed and were commonly captured in low numbers at all study sites.

We investigated the food habits of these forage fish by sampling their potential prey items, such as zooplankton and macroinvertebrates (animals that lack backbones and are big enough to be seen with the naked eye). These items were collected with plankton nets and from samples of sediment and vegetation. Some samples of captured juvenile surf smelt and sand lance were retained for diet and stable isotope analysis, which will allow us to map the fishes' position in the food web. The

(Forage Fish continued on page 3)



Central Puget Sound, Washington, showing location of forage fish study area.

Sound Waves

Editor
Helen Gibbons
Santa Cruz, California
Telephone: (831) 460-7418
E-mail: hgibbons@usgs.gov
Fax: (831) 427-4709

Print Layout Editors
Susan Mayfield, Sara Boore
Menlo Park, California
Telephone: (650) 329-5066
E-mail: smayfiel@usgs.gov; sboore@yahoo.com
Fax: (650) 329-5051

Web Layout Editor
Jolene Gittens
St. Petersburg, Florida
Telephone: (727) 803-8747 Ext. 3038
E-mail: jgittens@usgs.gov
Fax: (727) 803-2032

SOUND WAVES (WITH ADDITIONAL LINKS) IS AVAILABLE ONLINE AT URL **http://soundwaves.usgs.gov/**

Contents

Submission Guidelines

Deadline: The deadline for news items and publication lists for the July/August issue of *Sound Waves* is Monday, May 6, 2013.
Publications: When new publications or products are released, please notify the editor with a full reference and a bulleted summary or description.
Images: Please submit all images at publication size (column, 2-column, or page width). Resolution of 200 to 300 dpi (dots per inch) is best. Adobe Illustrator© files or EPS files work well with vector files (such as graphs or diagrams). TIFF and JPEG files work well with raster files (photographs or rasterized vector files).

U.S. Geological Survey
Earth Science Information Sources:

Need to find natural-science data or information? Visit the USGS Frequently Asked Questions (FAQ's) at URL **http://www.usgs.gov/faq/**

Can't find the answer to your question on the Web? Call 1-888-ASK-USGS

Want to e-mail your question to the USGS? Send it to this address: ask@usgs.gov

(Forage Fish continued from page 2)

samples that the team collected during this survey are currently being analyzed, and the results will be integrated with other components of the CHIPS program, allowing us to better understand the role of forage fish in the marine food web of Puget Sound.

This study is part of a larger effort within the Effects of Urbanization project task under the CHIPS program (**http://puget.usgs.gov/urban/**). CHIPS is an interdisciplinary collaboration designed to coordinate, integrate, and link USGS studies with the goals and objectives of Federal, State, Tribal, and local governments, along with nongovernmental organizations (NGOs), universities, and private industry. The efforts described here will be integrated with current and future habitat assessments.

If you would like additional information about this work, please contact **Theresa Liedtke** (**tliedtke@usgs.gov**). To view a selection of photographic highlights from this survey, visit the USGS Facebook page at **https://www.facebook.com/media/set/?set=a.451665814879407.102143.102635589782433&type=1**. A USGS Fact Sheet about forage fish studies in Puget Sound is posted at **http://pubs.usgs.gov/fs/2012/3023/**. ❁

*USGS crew member **Lisa Gee** retrieves a plankton net that was deployed to sample potential prey items of juvenile forage fish. USGS photograph by **David Ayers**.*

Research

Groundbreaking Gas Hydrate Research

By Carolyn Ruppel, Jessica Robertson, and Brenda Pierce

[Expanded from USGS Science Features: Top Story at **http://www.usgs.gov/blogs/features/usgs_top_story/groundbreaking-gas-hydrate-research/**]

As widely reported in the news media, Japan produced methane from deepwater gas hydrate deposits for the first time in March 2013. This crucial milestone along the research-and-development pathway toward proving that gas hydrates may eventually be an energy resource was achieved by Japan's Research Consortium for Methane Hydrate Resources (known as MH21, **http://www.mh21japan.gr.jp/english/**). Two months earlier, in January 2013, U.S. Geological Survey (USGS) Gas Hydrates Project personnel from the Woods Hole Coastal and Marine Science Center in Woods Hole, Massachusetts, collaborated with researchers from the Georgia Institute of Technology (Georgia Tech); the Japan Oil, Gas and Metals National Corporation (JOGMEC, **http://www.jogmec.go.jp/english/**); and Japan's National Institute of Advanced Industrial Science and Technology (AIST, **http://www.aist.go.jp/index_en.html**) to analyze special sediment cores retrieved from the area of the deepwater production test. The collaboration continues a long-standing relationship between national methane hydrates research programs in Japan and the United States, and it represents the first time that U.S. researchers have been directly involved in studying Japanese gas hydrate samples.

*Methane hydrate is sometimes called "the ice that burns" because the warming hydrates release enough methane to sustain a flame. USGS photograph by **J. Pinkston** and **L. Stern**.*

What are Gas Hydrates?

Gas hydrates are a naturally occurring, ice-like form of methane gas combined with water. They sequester large amounts of methane, making them a potentially significant source for natural gas around the world.

Gas hydrates form when methane—and sometimes other gases—combines with water at specific pressure and temperature conditions. These pressure-temperature conditions keep the gas hydrate "stable," meaning it is intact and gases are contained in a solid form. Gas hydrates are widespread in marine sediments beneath the ocean floor and in sediments within and beneath permafrost.

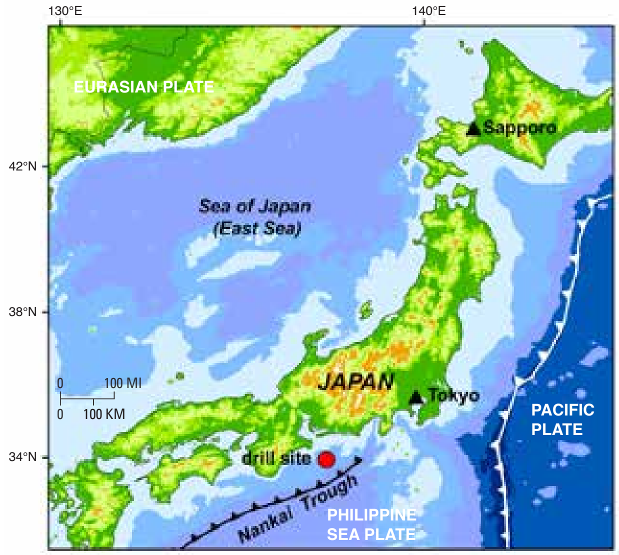
Premier Research in Japan Enhances Understanding in the United States

In 2012, JOGMEC and AIST researchers used innovative technology to retrieve and preserve sediment samples contain-

(Gas Hydrate Research continued on page 4)

(Gas Hydrate Research continued from page 3)

ing gas hydrate from the seafloor in the Nankai Trough area, offshore Japan. Such well-preserved hydrate-bearing sediment samples are rare. They are preserved as "pressure cores," with the gas hydrates maintained at the pressure at which they formed beneath the seafloor. Maintaining these pressure conditions and storing the recovered cores at low temperatures in walk-in freezers ensure that the gas hydrate in the cores remains intact. Researchers have been refining pressure-core technology since the 1990s, and the version of the pressure corer used in the Nankai Trough was designed specifically to retrieve coarse-grained (for example, sandy) hydrate-bearing sediments, where the highest saturations of gas hydrate are likely to occur. The pressure corer used offshore Japan was developed as part of an ongoing collaboration among Japan, the U.S. Department of Energy (DOE, **http://energy.gov/**), and the Gulf of Mexico Gas Hydrate Joint Industry Program (JIP, **http://gomhydratejip.ucsd.edu/**).



*Japan, showing location of the drill site (red dot) where the Research Consortium for Methane Hydrate Resources in Japan (MH21, **http://www.mh21japan.gr.jp/english/**) produced methane from deepwater gas hydrate deposits in March 2013. The gas hydrate-bearing pressure cores studied by U.S. and Japanese researchers in January 2013 came from the same location. White curve shows trench where the Pacific plate subducts beneath Japan and the Philippine Sea plate. Black curve indicates the Nankai Trough, where the Philippine Sea plate subducts beneath Japan.*

Innovative Technology to Study the Samples

During January's joint laboratory program in Sapporo, Japan, U.S. and Japanese researchers analyzed the pressure cores using specialized devices that keep the cores at their natural, stable conditions. The devices, called Pressure Core Characterization Tools (PCCT), were designed and built by geotechnical engineer **Carlos Santamarina** at Georgia Tech, with long-term support from DOE and JIP. Examples of PCCT devices are a manipulator for moving pressure cores from storage chambers into various testing chambers, special pressure vessels that measure the strength of the sediments and how quickly fluids can flow through them, and a biological chamber that can be used to study the microbes that live in the deep-sea sediments. (Learn more from PDF file at **http://www.iodp.org/doc_download/3531-44-48sd14pressurecorepdf** [692 KB].)

A key tool in the suite of PCCT instruments is the Instrumented Pressure Testing Chamber (IPTC), which was the first device capable of measuring certain properties of pressure cores without first depressurizing them. The IPTC was built by Georgia Tech in 2005 and has previously been deployed by Santamarina and his graduate students to analyze pressure cores obtained from the Gulf of Mexico, offshore India, and the Ulleung Basin offshore Korea. USGS researchers, led by engineer **Bill Winters** and Gas Hydrates Project laboratory chief **Bill Waite**, now operate, maintain, and spearhead improvements to the IPTC, with technical assistance from USGS technicians **Dave Mason** and **Emile Bergeron** (**http://woodshole.er.usgs.gov/project-pages/hydrates/lab.html**).

Testing the PCCT instruments in Japan was an important step in preparing

(Gas Hydrate Research continued on page 5)

*International team studying gas hydrates in Japan, January 2013. Front row, kneeling: **Jun Yoneda** (Japan's National Institute of Advanced Industrial Science and Technology [AIST]). Front row, standing, left to right: **Yoshihiro Konno** (AIST), **Jiro Nagao** (AIST), **Marco Terzariol** (Georgia Tech), **William Winters** (USGS), **Junbong Jang** (Georgia Tech), **Kiyofumi Suzuki** (Japan Oil, Gas and Metals National Corporation [JOGMEC]), **Sheng Dai** (Georgia Tech), **Tetsuya Fujii** (JOGMEC), and **Emile Bergeron** (USGS). Back row, standing, left to right: **William Waite** (USGS), **Efthymios Papadopoulos** (Georgia Tech), **David Mason** (USGS), and **Carlos Santamarina** (Georgia Tech). Photograph courtesy of **William Winters**, USGS.*

(Gas Hydrate Research continued from page 4)

USGS and Georgia Tech researchers for the analysis of pressure cores that may be obtained in the future from gas hydrate deposits in the deepwater Gulf of Mexico and on the Alaskan North Slope. Along with offshore Japan, these areas are ideal locations for future research to assess the occurrence and production potential of gas hydrates.

USGS Weighs In

"This research will not only help us understand the character of gas hydrates in Japan, but we can also apply that knowledge, as well as this innovative technology and approach, to understand the potential in the U.S. and around the world," said **Brenda Pierce**, USGS Energy Resources Program Coordinator. "This project brings together international experts, each with specialized knowledge to share about these important hydrate deposits. The USGS is excited that our Japanese colleagues have invited us to participate in this project along with Georgia Tech."

Mini-Production Tests and Future Publications

The IPTC is also capable of conducting mini-production tests on hydrate-bearing sediments. During these tests, cores are depressurized at closely controlled rates to break down the methane hydrate and release natural gas. By measuring the volume of gas produced and the rate of production, insight may be gained regarding the potential behavior of the gas hydrate reservoirs. Georgia Tech has previously completed such tests on pressure cores from offshore India and Korea.

As part of the program in Japan, AIST manufactured an IPTC for completion of laboratory production tests on the Nankai Trough pressure cores. Coupling the results of mini-production tests with those from field-scale tests done in March 2013 will yield new insights that may lead to the realization of gas hydrates as an energy resource.

Financial Support

This collaborative research in Japan was financially supported by MH21, the USGS, DOE, and JIP.

*Scientists from Japan's National Institute of Advanced Industrial Science and Technology (AIST); Japan Oil, Gas and Metals National Corporation (JOGMEC); Georgia Tech; and the USGS prepare to analyze pressure cores in January 2013 as part of a multi-year gas hydrates research project in Japan. Left to right: **Junbong Jang** (Georgia Tech), **David Mason** (USGS), **Carlos Santamarina** (Georgia Tech), and **Emile Bergeron** (USGS). A ball valve has just been opened, allowing a pressure core to be transferred using a manipulator (background) from a short-term storage chamber (center) through a ball valve, into the Instrumented Pressure Testing Chamber (IPTC) where it will be tested. Additional photographs of the international research team conducting analysis in Japan are posted at the USGS Multimedia Gallery, **http://gallery.usgs.gov/tags/GasHydrates**. USGS photograph by **William Winters**.*

USGS Gas Hydrates Project

The USGS Gas Hydrates Project (**http://woodshole.er.usgs.gov/project-pages/hydrates/**) is a globally recognized research effort that focuses on energy, climate, and geohazard issues associated with natural-gas hydrates. Research locations include the northern Gulf of Mexico, the Alaskan North Slope, the Arctic Ocean, the Bering Sea, and the U.S. Atlantic Ocean margin, as well as Japan, India, and Korea (**http://energy.usgs.gov/OilGas/UnconventionalOilGas/GasHydrates.aspx**). ☸

*Gas hydrate recovered in shallow layers just below the seafloor during piston coring in the Mississippi Canyon in the northern Gulf of Mexico in 2002. Photograph courtesy of **William Winters**, USGS.*

Interactive Tool for Assessing Climate-Change Impacts Along the North-Central California Coast Supported by USGS Modeling System

By Patrick Barnard and Helen Gibbons

Unusually high tides, sometimes called "king tides," offer a preview of coastal flooding likely to result from rising sea level. In this photograph, taken during a king tide on February 17, 2011, waves overtop Pier 14 in San Francisco, California. (Towers in background are supports of the San Francisco-Oakland Bay Bridge.) Photograph by ***Mike Schweizer (http://www.flickr.com/photos/9351872@N07/5453838525/in/pool-bayareakingtides/)****.*

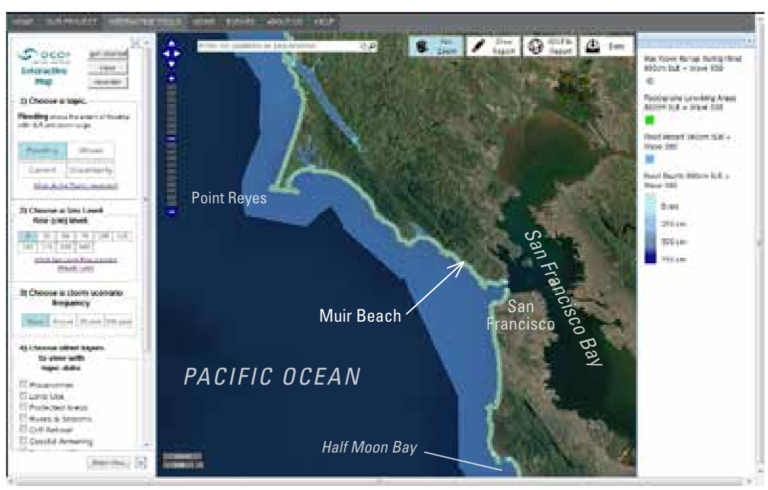
U.S. Geological Survey (USGS) scientists, in collaboration with the National Oceanic and Atmospheric Administration (NOAA) and PRBO Conservation Science (formerly Point Reyes Bird Observatory), recently released the beta version of an interactive tool for assessing climate-change impacts along the north-central California coast. The new Climate Impacts Tool, which currently covers the California coastline from Half Moon Bay to Bodega Bay (see map), was posted on February 20, 2013, at **http://data.prbo.org/apps/ocof/**. The new tool is part of Our Coast Our Future (OCOF), a project that seeks to provide science-based decision-support tools to natural-resource managers, local governments, and others in the San Francisco Bay region to help them understand, visualize, and anticipate local coastal climate-change impacts within the bay and along the outer coast.

The technical underpinning of the new Climate Impacts Tool is the Coastal Storm Modeling System (CoSMoS), a numerical modeling system developed by the USGS and Netherlands-based research institute Deltares (**http://www.deltares.nl/en**) to predict coastal flooding caused by both sea-level rise and storms driven by climate change.

Sea level along the California coast is expected to rise by as much as 1.7 meters (approximately 6 feet) by 2100 (National Research Council, 2012, **http://www.nap.edu/catalog.php?record_id=13389**). Winter storms can elevate coastal water levels by an additional 5 meters (approximately 16 feet) or more, primarily because of large waves and storm surge (rise in water level caused by low atmospheric pressure and wind). The additional water-level rise caused by severe storms is addressed in the CoSMoS modeling system, enabling its users to more accurately assess the future vulnerability of coastlines to flooding caused by climate change.

CoSMoS modeling begins with feeding the results of the latest global climate models (from an international clearing house at **http://cmip-pcmdi.llnl.gov/cmip5**) into a global wave model to predict wave conditions for the U.S. west coast through 2100. These offshore wave conditions, combined with predicted tides and storm surge, are scaled down to the local level with state-of-the-art numerical modeling tools to predict coastal water levels. The water levels are then projected onto a digital elevation model (DEM) with a 2-meter grid (a grid consisting of squares 2 meters on a side, with each square assigned an elevation value). DEMs, like the more familiar topographic maps, show the shape and elevation of the ocean floor and land surface; projecting predicted water levels onto coastal DEMs can be used to estimate the likely extent of flooding. For the north-central California coast, CoSMoS has performed this exercise across the full plausible range of anticipated sea-

(Climate Impacts Tool continued on page 7)



*Screenshot of interactive map (with added place names) from Our Coast Our Future (OCOF) Web site (**http://data.prbo.org/apps/ocof/**). Map shows most of the shoreline currently covered by the Climate Impacts Tool for assessing climate-change impacts along the north-central California coast, from Half Moon Bay to Bodega Bay, California (Bodega Bay is just beyond top of map). White arrow points to location of Muir Beach images, below.*

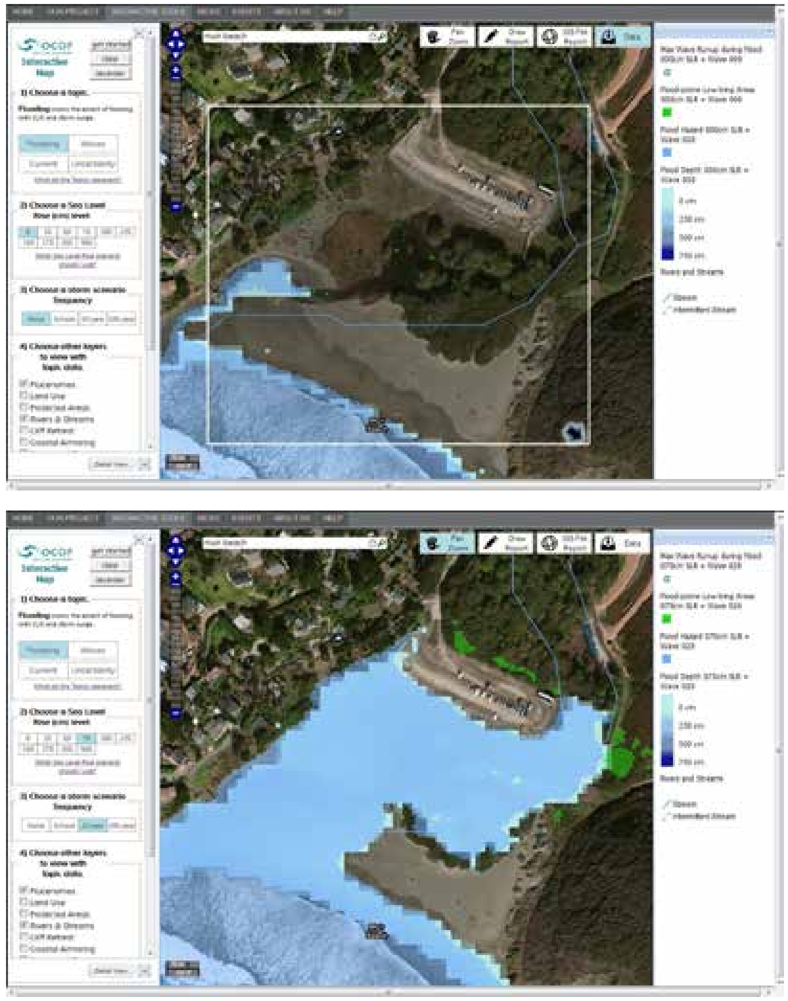
(Climate Impacts Tool continued from page 6)

level rise and storm conditions predicted by the global climate models.

The USGS CoSMoS team includes project manager **Patrick Barnard** (who is also co-principal investigator, along with **Grant Ballard** of PRBO Conservation Science, on the Our Coast Our Future project), lead modeler/coastal engineer **Li Erikson**, geologist **Amy Foxgrover**, and oceanographer **Andy O'Neill**. Deltares collaborators include **Maarten van Ormondt** and **Edwin Elias**.

The CoSMoS team is currently expanding the modeling system to support coastal-management decisions along shorelines in San Francisco Bay and southern California. CoSMoS not only can serve as a long-term planning tool, but—when extreme storms are approaching—is capable of serving as a real-time warning system for emergency managers, lifeline operators, and resource managers.

Learn more about CoSMoS in *The Framework of a Coastal Hazards Model—A Tool for Predicting the Future Impact of Severe Storms* (USGS Open-File Report 2009–1073) at **http://pubs.usgs.gov/of/2009/1073/** or contact **Patrick Barnard**, **pbarnard@usgs.gov**. Learn more about Our Coast Our Future at **http://data.prbo.org/apps/ocof/**. For an explanation of climate modeling, see **http://www.wmo.int/pages/themes/climate/climate_models.php**. ☸



*Screenshots of Our Coast Our Future (**http://data.prbo.org/apps/ocof/**) interactive map views of Muir Beach, California. Upper image shows present coastline during non-storm conditions. Lower image shows extent of flooding predicted by the recently released Climate Impacts Tool if the area is subjected to a sea-level rise of 75 centimeters (about 30 inches) and elevated water levels caused by a 20-year-recurrence-interval coastal storm with an offshore wave height of 9.1 meters (approximately 30 feet).*

Outreach

Sooty Shearwater Migration on Display in Channel Islands National Marine Sanctuary

Research by seabird ecologists **Josh Adams** of the U.S. Geological Survey (USGS), **James Harvey** of Moss Landing Marine Laboratories (MLML), and their colleagues is on display at a new boating-instruction and safety center at the Channel Islands Harbor in Oxnard, California. The display was designed in part by seabird ecologist **Bill Henry** (USGS and MLML), who is working with Adams on additional outreach, including a California

(Sooty Shearwater Display continued on page 8)

*Sooty Shearwater (*Puffinus griseus*) taking flight offshore of Capitola, California, in the Monterey Bay National Marine Sanctuary. USGS photograph by **Jonathan Felis**, taken September 11, 2012.*

(Sooty Shearwater Display continued from page 7)

Current Seabird Telemetry Atlas. The new display is part of a “Crossroads of the Underwater World” exhibit, highlighting the Channel Islands National Marine Sanctuary’s role as a global destination for foraging whales and seabirds.

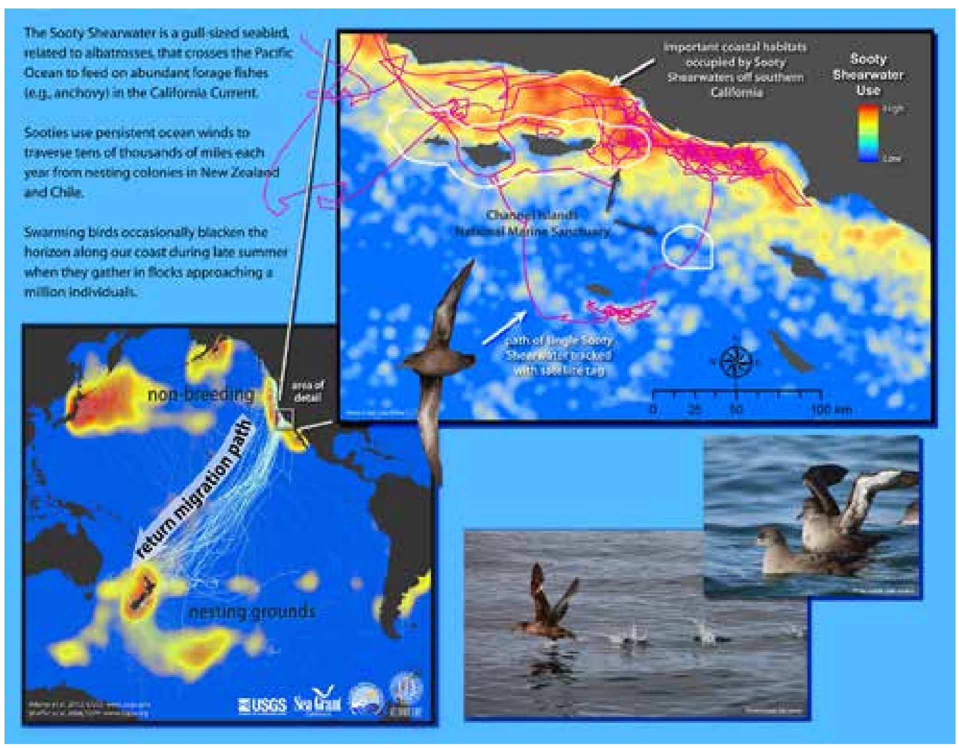
Adams and colleagues tracked Sooty Shearwaters (*Puffinus griseus*) with miniature satellite transmitters. Their goal was to identify the birds’ critical at-sea feeding grounds and residence times within the U.S. Exclusive Economic Zone (from the coastline out to 200 nautical miles) and within the U.S. west coast’s five National Marine Sanctuaries (**http://sanctuaries.noaa.gov/about/westcoast.html**). The results of their research were reported in the November–December 2012 issue of *Biological Conservation* (**http://dx.doi.org/10.1016/j.biocon.2011.12.032**). Wildlife and resource managers may use their tracking data to selectively protect key habitat areas from harm.

Funded in part by California Sea Grant, the satellite-tracking study documents the important foraging hotspots within the California Current ecosystem. Sooty Shearwaters travel tens of thousands of miles a year, one of the longest animal migrations ever documented. The birds are also famous for forming flocks so massive they turn the sky dark.

“We see all these birds coming from so far away to our local waters,” said **Julie Bursek**, an education and outreach coordinator with the Channel Islands National Marine Sanctuary, managed by the National Oceanic and Atmospheric Administration (NOAA). “The science helps us develop our message of why the Channel Islands are such a special and important area for marine life.”

The Channel Islands Boating Center (**http://www.ciboatingcenter.org/**), which officially opened April 3, 2012, is operated by California State University Channel Islands as a center for boating, kayaking, rowing, and other water sports. NOAA Channel Islands National Marine Sanctuary (**http://channelislands.noaa.gov/**) will lead marine education and outreach programs in collaboration with its many partners.

*Flock of Sooty Shearwaters (*Puffinus griseus*) offshore of Capitola, California, in the Monterey Bay National Marine Sanctuary. USGS photograph by* ***Jonathan Felis****, taken September 11, 2012.*



*Excerpt from Sooty Shearwater display at new Channel Islands Boating Center (****http://www.ciboatingcenter.org/****). (Visit* **http://soundwaves.usgs.gov/2013/04/outreach.html** *to view larger size.)*

Future of Pacific Northwest Seagrasses in a Changing Climate

By Renee K. Takesue

Seagrasses provide crucial habitat for fish, birds, and invertebrates and serve as indicators of nearshore ecosystem health. As evidence of its ecological value, eelgrass (*Zostera marina*), one of six species of seagrass in the Pacific Northwest, is protected by a no-net-loss policy for shoreline development in the State of Washington. Moreover, Washington has set a target of increasing eelgrass habitat in Puget Sound by 20 percent by the year 2020. Near-term seagrass protection and enhancement goals in the Pacific Northwest could be affected by climate-change components that alter nearshore atmospheric, oceanic, and coastal attributes and processes, such as changing temperature, storminess, precipitation, runoff, sea level, upwelling, and ocean acidification. To explore the implications of such changes for seagrass research, restoration, resilience, and adaptation, 35 climatologists, seagrass researchers, and resource managers from universities, the Northwest Indian College, and State and Federal agencies gathered at the University of Washington's Friday Harbor Laboratories January 23–25, 2013, for a workshop titled "The Future of Pacific Northwest Seagrasses in a Changing Climate." The goals of the workshop—cosponsored by the U.S. Geological Survey (USGS), the Washington Department of Natural Resources, the U.S. Environmental Protection Agency, and Washington Sea Grant—were to quantify impacts and mechanisms, discuss the current state of scientific knowledge, and identify critical issues, data gaps, and uncertainties.

*USGS geochemist **Renee Takesue** installing a sensor to monitor turbidity over an eelgrass (*Zostera marina*) bed near the Nisqually Delta restoration site in Puget Sound, Washington, where increased water and sediment fluxes resulting from dike-breaching could impact eelgrass habitat. Photograph courtesy of **Michael Imes**.*

The 2½-day workshop began with an introductory talk and question-and-answer session by **Guillaume Mauger**, a climatologist in the University of Washington's Climate Impacts Group who described Pacific Northwest climate variability, climate change, and uncertainties about future projections out to 2100. The main body of the workshop consisted of six topical sessions about climate-change components important for Pacific Northwest seagrasses. Each session began with a short topical talk by a guest speaker: **W. Jud Kenworthy** (retired National Oceanic and Atmospheric Administration [NOAA]) spoke about water temperature; **Andrew Stevens** (USGS) about storminess; **Ken Moore** (Virginia Institute of Marine Sciences), precipitation and runoff; **John Rybczek** (Western Washington University), sea-level rise; **Francis Chan** (Oregon State University), coastal upwelling; and **Dick Zimmerman** (Old Dominion University) and **Justin Campbell** (Smithsonian Institution), ocean acidification. The talks were followed by 2 to 3 hours of round-table discussion about implications for seagrasses in coastal estuaries of northern California, Oregon, Washington, and British Columbia and in the inland seas of Puget Sound and the Strait of Georgia (a body of water between Canada's Vancouver Island and British Columbia). Scientific posters displayed in gathering areas plus long lunch breaks and evening social hours fostered informal discussions and interactions among participants.

Workshop attendees agreed that there could be more negative than positive impacts of climate change on Pacific Northwest seagrasses; however, they recognized that certain components could have disproportionate effects. For example, eelgrass, which depends on aqueous carbon dioxide (CO_2) as a carbon source, may benefit several-fold from higher seawater CO_2 concentrations projected to result from increasing atmospheric CO_2. A 1 to 2 degree Celsius (°C) increase in temperature, on the other hand, may have less of an effect because it is projected to occur mainly in winter, when water temperature averages only 8° C. Such an increase would be well within the tolerance range of Pacific Northwest seagrasses.

(Seagrasses Workshop continued on page 10)

(Seagrasses Workshop continued from page 9)

Although first-order climate-change impacts were the primary focus of the workshop, indirect impacts—such as nutrient-induced algal blooms, sediment runoff from watersheds, cascading effects in the food web, and human interactions—could also affect seagrass resilience and adaptation in a changing climate. Hydrodynamic and ecologic models already under development by several of the workshop participants were recognized as a way to understand the complexity of ecosystem linkages and feedbacks resulting from climate change in the Pacific Northwest.

At the end of the workshop, participants volunteered to coauthor three publications about the workshop and its outcomes: (1) an executive summary in a citable report series for distribution to general audiences; (2) a peer-reviewed journal article summarizing workshop discussions and conclusions for the international seagrass research community; and (3) a peer-reviewed journal article for resource managers, presenting restoration priorities and recommendations for seagrass protection, conservation, and enhancement. ❁

*Canada Geese (*Branta canadensis*) grazing on eelgrass (*Zostera marina*) in Puget Sound, Washington. **David Ward**, biologist at the USGS Alaska Science Center, reported at the "Future of Pacific Northwest Seagrasses in a Changing Climate" workshop that temperature-induced shifts in the growing season of eelgrass can affect migratory pathways of waterfowl, such as Black Brants (*Branta bernicla nigricans*), that depend on this seagrass. USGS photograph by **Renee Takesue**.*

Staff and Center News

USGS Postdoctoral Researcher Studying Effects of Dam Removal on Marine Ecosystems

Melissa Foley has joined the U.S. Geological Survey (USGS) Pacific Coastal and Marine Science Center as a postdoctoral researcher in the USGS Mendenhall Research Fellowship Program (**http://geology.usgs.gov/postdoc/**).

Melissa received her Ph.D. in marine ecology from the University of California, Santa Cruz, where her research focused on the movement of materials across the land-sea interface and the influences of land-based materials on nearshore marine-ecosystem structure and functioning. After earning her Ph.D., Melissa was an early career fellow at Stanford University's Center for Ocean Solutions, where she worked on the center's Ecosystem Health Initiative (**http://www.centerforoceansolutions.org/initiatives/ecosystem-health-initiative**).

Melissa is focusing her USGS postdoctoral work on how two large dam removals on the Elwha River in the State of Washington will affect marine ecosystems.

"The timing of her hiring could not be more perfect," said USGS geologist **Jon Warrick**, one of Melissa's co-advisors, "because we are just beginning to see large changes in the Elwha nearshore morphology from the massive releases of sediment into the river."

Melissa's postdoctoral work will focus mostly on the patterns and impacts of turbidity, sedimentation, and nutrient flux related to the dam removals—a focus that will make her work applicable to other large-scale restoration and sediment-management activities around the world.

In addition to Warrick, Melissa's co-advisors are **Amy Draut** (USGS), **Chris Magirl** (USGS), **Jennifer Bountry** (U.S. Bureau of Reclamation), and **Matt Beirne** (Lower Klallam Elwha Tribe).

Welcome, Melissa! ❁

Melissa Foley

Recently Published Articles

Ackerman, J.T., Herzog, M.P., and Schwarzbach, S.E., 2013, Methylmercury is the predominant form of mercury in bird eggs; a synthesis: Environmental Science and Technology, v. 47, no. 4, p. 2052–2060, doi:10.1021/es304385y [**http://dx.doi.org/10.1021/es304385y**].

Andrews, B.D., Ackerman, S.D., Baldwin, W.E., Foster, D.S., and Schwab, W.C., 2013, High-resolution geophysical data from the inner continental shelf at Vineyard Sound, Massachusetts: U.S. Geological Survey Open-File Report 2012–1006, DVD-ROM [**http://pubs.usgs.gov/of/2012/1006/**].

Apotsos, A., Gelfenbaum, G., and Jaffe, B., 2012, Time-dependent onshore tsunami response: Coastal Engineering, v. 64, p. 73–86, doi:10.1016/j.coastaleng.2012.01.001 [**http://dx.doi.org/10.1016/j.coastaleng.2012.01.001**].

Atwater, B.F., ten Brink, U.S., Buckley, M., Halley, R.S., Jaffe, B.E., Lopez-Venagas, A.M., Reinhardt, E.G., Tuttle, M.P., Watt, S., and Wei, Y., 2012, Geomorphic and stratigraphic evidence for an unusual tsunami or storm a few centuries ago at Anegada, British Virgin Islands, Natural Hazards, v. 63, no. 1, p. 51–84. doi:10.1007/s11069-010-9622-6 [**http://dx.doi.org/10.1007/s11069-010-9622-6**].

Barnard, P.L., Foxgrover, A.C., Elias, E.P.L., Erikson, L.H., Hein, J.R., McGann, M., Mizell, K., Rosenbauer, R.J., Swarzenski, P.W., Takesue, R.K., Wong, F.L. and Woodrow, D.L., 2013, Integration of bed characteristics, geochemical tracers, current measurements, and numerical modeling for assessing the provenance of beach sand in the San Francisco Bay coastal system: Marine Geology, v. 336, p. 120–145 and Special Issue SF Bay, 26 p., doi:10.1016/j.margeo.2012.11.008 [**http://dx.doi.org/10.1016/j.margeo.2012.11.008**].

Barnard, P.L., Hubbard, D.M. and Dugan, J.E., 2012, Beach response dynamics of a littoral cell using a 17-year single-point time series of sand thickness: Geomorphology, v. 139–140, p. 588–598, doi:10.1016/j.geomorph.2011.12.023 [**http://dx.doi.org/10.1016/j.geomorph.2011.12.023**].

Buckley, M.L., Wei, Y., Jaffe, B.E., and Watt, S.G., 2012, Inverse modeling of velocities and inferred cause of overwash that emplaced inland fields of boulders at Anegada, British Virgin Islands: Natural Hazards, v. 63, no. 1, p. 133–149, doi:10.1007/s11069-011-9725-8 [**http://dx.doi.org/10.1007/s11069-011-9725-8**].

Buscombe, D., and Rubin, D.M., 2012, Advances in the simulation and automated measurement of well-sorted granular material; 1, simulation: Journal of Geophysical Research–Earth Surface, v. 117, F02001, 17 p., doi:10.1029/2011JF001974 [**http://dx.doi.org/10.1029/2011JF001974**].

Buscombe, D., and Rubin, D.M., 2012, Advances in the simulation and automated measurement of well sorted granular material; 2, direct measures of particle properties: Journal of Geophysical Research–Earth Surface, v. 117, F02002, 18 p., doi:10.1029/2011JF001975 [**http://dx.doi.org/10.1029/2011JF001975**].

Conaway, C.H., Draut, A.E., Echols, K.R., Storlazzi, C.D., and Ritchie, A., 2012, Episodic suspended sediment transport and elevated polycyclic aromatic hydrocarbons in a small, mountainous river in coastal California: River Research and Applications, 14 p., published online June 7, 2012, doi:10.1002/rra.2582 [**http://dx.doi.org/10.1002/rra.2582**].

Conaway, C.H., Storlazzi, C.D., Draut, A.E., and Swarzenski, P.W., 2013. Short-term variability of ^{7}Be atmospheric deposition and watershed response in a Pacific coastal stream, Monterey Bay, California, USA: Journal of Environmental Radioactivity, v. 120, p. 94–103, doi:10.1016/j.jenvrad.2013.02.004 [**http://dx.doi.org/10.1016/j.jenvrad.2013.02.004**].

Dalyander, P.S., Butman, B., Sherwood, C.R., Signell, R.P., and Wilkin, J.L., 2013, Characterizing wave- and current-induced bottom shear stress—U.S. middle Atlantic continental shelf: Continental Shelf Research, v. 52, p. 73–86, doi:10.1016/j.csr.2012.10.012 [**http://dx.doi.org/10.1016/j.csr.2012.10.012**].

Denny, J.F., Schwab, W.C., Baldwin, W.E., Barnhardt, W.A., Gayes, P.T., Morton, R.A., Warner, J.C., Driscoll, N.W., and Voulgaris, G., 2013, Holocene sediment distribution on the inner continental shelf of northeastern South Carolina—implications for the regional sediment budget and long-term shoreline response: Continental Shelf Research, v. 56, p. 56–70, doi:10.1016/j.csr.2013.02.004 [**http://dx.doi.org/10.1016/j.csr.2013.02.004**].

Draut, A.E., 2012, Effects of river regulation on aeolian landscapes, Colorado River, southwestern USA: Journal of Geophysical Research—Earth Surface, v. 117, F02022, 22 p., doi:10.1029/2011JF002329 [**http://dx.doi.org/10.1029/2011JF002329**].

Draut, A.E., and Clift, P.D., 2013, Differential preservation in the geologic record of intraoceanic arc sedimentary and tectonic processes: Earth-Science Reviews, v. 116, p. 57–84, doi:10.1016/j.earscirev.2012.11.003 [**http://dx.doi.org/10.1016/j.earscirev.2012.11.003**].

Draut, A.E., Redsteer, M.H., and Amoroso, L., 2012, Recent seasonal variations in arid landscape cover and aeolian sand mobility, Navajo Nation, southwestern U.S., *in* Giosan, L., Fuller, D.Q., Nicoll, K., Flad, R.K., and Clift, P.D., eds., Climate, landscapes and civilizations: American Geophysical Union Geophysical Monograph 198, p. 51–60, [**http://www.agu.org/books/gm/v198/**].

Draut, A.E., Redsteer, M.H., and Amoroso, L., 2012, Vegetation, substrate, and aeolian sand transport at Teesto Wash, Navajo Nation, 2009–12: U.S. Geological Survey Scientific Investigations Report 2012–5095, 71 p., [**http://pubs.usgs.gov/sir/2012/5095/**].

Elias, E.P.L., and Hansen, J.E., 2012, Understanding processes controlling sediment transports at the mouth of a highly energetic inlet system (San Francisco Bay, CA): Marine Geology, published online July 15, 2012, doi:10.1016/j.margeo.2012.07.003 [**http://dx.doi.org/10.1016/j.margeo.2012.07.003**].

(Recently Published continued on page 12)

(Recently Published continued from page 11)

Flocks, J., Twichell, D., and Pendleton, E., 2013, Coast-wide geologic-assessment projects—unraveling regional coastal evolution [abs.]: Association for the Sciences of Limnology and Oceanography (ASLO) Aquatic Sciences Meeting, New Orleans, La., February 17–22, 2013 [**http://www.sgmeet.com/aslo/neworleans2013/viewabstract2.asp?AbstractID=11606**].

Futch, J.C., Griffin, D.W., and Lipp, E.K., 2012, Navigational inlets are conduits for land-based sources of pollution, *in* Kruczynski, W.L., and Gletcher, P.J., eds., Tropical connections—South Florida's marine environment: IAN Press, University of Maryland Center for Envrionmental Science, Cambridge, Md., p. 149 [**http://ian.umces.edu/press/books/publication/374/tropical_connections_south_florida_s_marine_environment_2012-07-02/**].

Galkiewicz, J., Vega-Thurber, R., and Kellogg, C., 2012, Metagenomic analysis of the microbial community associated with *Lophelia pertusa* [abs.]: International Coral Reef Symposium, 12th, Cairns, Australia, July 9–13, 2012, p. 400 [**http://www.icrs2012.com/ScientificProgram.htm**].

Gallien, T.W., Barnard, P.L., van Ormondt, M., Foxgrover, A.C., and Sanders, B.F., 2012, A parcel-scale coastal flood forecasting prototype for a Southern California urbanized embayment: Journal of Coastal Research, published online November 6, 2012, doi:10.2112/JCOASTRES-D-12-00114.1 [**http://dx.doi.org/10.2112/JCOASTRES-D-12-00114.1**].

Goff, J., Chagué-Goff, C., Nichol, S., Jaffe, B., and Dominey-Howes, D., 2012, Progress in paleotsunami research: Sedimentary Geology, v. 243–244, p. 70–88, doi:10.1016/j.sedgeo.2011.11.002 [**http://dx.doi.org/10.1016/j.sedgeo.2011.11.002**].

Goto, K., Chagué-Goff, C., Goff, J., and Jaffe, B., 2012, The future of tsunami research following the 2011 Tohoku-oki event: Sedimentary Geology, v. 282, p. 1–13, doi:10.1016/j.sedgeo.2012.08.003 [**http://dx.doi.org/10.1016/j.sedgeo.2012.08.003**].

Gray, M.A., Pratte, Z.A., and Kellogg, C.A., 2013, Comparison of DNA preservation methods for environmental bacterial community samples: FEMS Microbiology Ecology, v. 83, no. 2, p. 468–477, doi:10.1111/1574-6941.12008 [**http://dx.doi.org/10.1111/1574-6941.12008**].

Griffin, D.W., and Naumova, E.N., 2012, Air quality and human health, *in* Morain, S.A., and Budge, A.M., eds., Environmental tracking for public health surveillance: London, CRC Press, p. 129–186 [**http://www.crcnetbase.com/isbn/9780203093276**].

Hallock, P., Baker, R.D., Carnahan, E.A., Curry, R., Downs, C.A., Dupont, J.M., Fauth, J.E., Fisher Moses, E.M., Halas, J.C., Halas, J.F., Hoare, A.M., Jaap, W.C., Lidz, B.H., Ramirez, A., Reich, C.D., Wallace, A.A., and Woodley, C.M., 2013, Applications of biomarkers and bioindicators [abs.]: Biscayne National Park Science Symposium, Palmetto Bay, Fla., February 27–28, 2013 [**http://www.biscaynescience.org/**].

Hart, K.M., Zawada, D.G., Fujisaki, I., and Lidz, B.H., 2013, Habitat use of breeding green turtles *Chelonia mydas* tagged in Dry Tortugas National Park, USA—making use of local and regional MPAs [abs.]: Annual Symposium on Sea Turtle Biology and Conservation, 33rd, Baltimore, Md., February 2–8, 2013.

Jaffe, B.E., Goto, K., Sugawara, D., Richmond, B.M., Fujino, S., and Nishimura, Y., 2012, Flow speed estimated by inverse modeling of sandy tsunami deposits; results from the 11 March 2011 tsunami on the coastal plain near the Sendai Airport, Honshu, Japan: Sedimentary Geology, v. 282, p. 90–109, doi:10.1016/j.sedgeo.2012.09.002 [**http://dx.doi.org/10.1016/j.sedgeo.2012.09.002**].

Kindinger, J.L., Lee, D.M., Kulp, M.A., Khalil, S.M., Buster, N.A., Flocks, J.G., Bernier, J.C., and Raynie, R., 2013, Louisiana Barrier-Island Comprehensive Monitoring (BICM) Program 2006–2010—beginnings of a large-scale coastal-system-monitoring program [abs.]: Association for the Sciences of Limnology and Oceanography (ASLO) Aquatic Sciences Meeting, New Orleans, La., February 17–22, 2013 [**http://www.sgmeet.com/aslo/neworleans2013/viewabstract2.asp?AbstractID=10943**].

Kuffner, I., and Hickey, T.D., 2012, Calcification over space and time in the subtropical Florida Keys, U.S.A. [abs.]: International Coral Reef Symposium, 12th, Cairns, Australia, July 9–13, 2012, p. 167 [**http://www.icrs2012.com/ScientificProgram.htm**].

Kuffner, I.B., Hickey, T.D., and Morrison, J.M., 2013, Calcification over space and time on the Florida Keys outer-reef tract [abs.]: Biscayne National Park Science Symposium, Palmetto Bay, Fla., February 27–28, 2013 [**http://www.biscaynescience.org/**].

Kuffner, I.B., Hickey, T.D., Brock, J.C., Grober-Dunsmore, R., and Bonito, V.E., 2013, Drivers of fish and benthic community structure on patch reefs in Biscayne National Park [abs.]: Biscayne National Park Science Symposium, Palmetto Bay, Fla., February 27–28, 2013 [**http://www.biscaynescience.org/**].

Lafferty, K.D., 2013, Parasites in marine food webs: Bulletin of Marine Science, v. 89, no. 1, p 123–134, doi:10.5343/bms.2011.1124 [**http://dx.doi.org/10.5343/bms.2011.1124**].

Lafferty, K.D., Rodriguez, D.A., and Chapman, A., 2013, Temporal and spatial variation in bird and human use of beaches in southern California: SpringerPlus, v. 2, no. 38, 14 p., doi:10.1186/2193-1801-2-38 [**http://dx.doi.org/10.1186/2193-1801-2-38**].

Lidz, B.H., and Zawada, D.G., 2013, Possible return of *Acropora cervicornis* at Pulaski Shoal, Dry Tortugas National Park, Florida: Journal of Coastal Research, v. 29, no. 2, p. 256–271, doi:10.2112/JCOASTRES-D-12-00078.1 [**http://dx.doi.org/10.2112/JCOASTRES-D-12-00078.1**].

Long, J.W., Plant, N.G., and Sallenger, A.H., Jr., 2013, Investigating interactions between a sand-starved barrier island and an artificial berm [abs.]: Gulf of Mexico Oil Spill and Ecosystem Science Conference, New Orleans, La., January 21–23, 2013 [**http://program.gulfofmexicoconference.org/2012/**

(Recently Published continued on page 13)

(Recently Published continued from page 12)

investigating-interactions-between-a-sandstarved-barrier-island-and-an-artificial-berm/].

Marra, J.J., Merrifield, M.A., Sweet, W.V., and others, 2012, Sea level and coastal inundation on Pacific islands, *in* Keener, V.W., Marra, J.J., Finucane, M.L., Spooner, D., and Smith, M.H., eds., Climate change and Pacific islands—indicators and impacts; report for the 2012 Pacific Islands Regional Climate Assessment (PIRCA): Washington, D.C., Island Press, p. 65–88 [**http://www.pacificrisa.org/projects/pirca/**].

Marrero, M., Hester, M., Hyrenbach, K.D., Michael, P., Adams, J., Keiper, C., Stock, J., Collins, A., Vanderlip, C., Alvarez, T., and Webb, S., 2013, Winged ambassadors—ocean literacy through the eyes of albatross: Current—The Journal of Marine Education, v. 28, no. 2, p. 26–30.

Mayo, M., Smoak, J.M., Smith, C., Fanning, K., and Smith, T.J., 2013, A comparison of uranium budgets for estuarine wetlands of the Everglades National Park, Florida and Mobile Bay, Alabama [abs.]: Association for the Sciences of Limnology and Oceanography (ASLO) Aquatic Sciences Meeting, New Orleans, La., February 17–22, 2013 [**http://www.sgmeet.com/aslo/neworleans2013/viewabstract2.asp?AbstractID=10988**].

Mignone, A., Stockdon, H., Willis, M., Cannon, J.W., and Thompson, R., 2012, On the use of wave parameterizations and a storm impact scaling model in National Weather Service coastal flood and decision support operations [abs.]: American Meteorological Society Annual meeting, 92nd, New Orleans, La., January 22–26, 2012, proceedings [**https://ams.confex.com/ams/92Annual/webprogram/Paper196615.html**].

Miller, S.E., Parker, B., and others, 2012. Marine, freshwater, and terrestrial ecosystems on Pacific islands *in* Keener, V.W., Marra, J.J., Finucane, M.L., Spooner, D., and Smith, M.H., eds., Climate change and Pacific islands—indicators and impacts; report for the 2012 Pacific Islands Regional Climate Assessment (PIRCA): Washington, D.C., Island Press, p. 89–118 [**http://www.pacificrisa.org/projects/pirca/**].

Miselis, J.L., Kindinger, J.L., and Buster, N.A., 2013, Refining the link between the Holocene development of the Mississippi River Delta and the geologic evolution of Cat Island, MS [abs.]: Association for the Sciences of Limnology and Oceanography (ASLO) Aquatic Sciences Meeting, New Orleans, La., February 17–22, 2013 [**http://www.sgmeet.com/aslo/neworleans2013/viewabstract2.asp?AbstractID=11803**].

Osterman, L.E., and Smith, C.G., 2012, Over 100 years of environmental change recorded by foraminifers and sediments in Mobile Bay, Alabama, Gulf of Mexico, USA: Estuarine, Coastal and Shelf Science, v. 115, p. 345–358, doi:10.1016/j.ecss.2012.10.001 [**http://dx.doi.org/10.1016/j.ecss.2012.10.001**].

Osterman, L.E., and Smith, C.G., 2013, A century of environmental degradation in Mobile Bay, Alabama, USA, recorded by foraminifers [abs.]: Association for the Sciences of Limnology and Oceanography (ASLO) Aquatic Sciences Meeting, New Orleans, La., February 17–22, 2013 [**http://www.sgmeet.com/aslo/neworleans2013/viewabstract2.asp?AbstractID=11467**].

Plant, N.G., and Stockdon, H.F., 2012, Probabilistic prediction of barrier-island response to hurricanes: Journal of Geophysical Research, v. 117, F03015, 17 p., doi:10.1029/2011JF002326 [**http://dx.doi.org/10.1029/2011JF002326**].

Pohlman, J.W., Riedel, M., Bauer, J.E., Canuel, E.A., Paull, C.K., Lapham, L., Grabowski, K.S., Coffin, R.B., and Spence, G.D., 2013, Anaerobic methane oxidation in low-organic content methane seep sediments: Geochimica et Cosmochimica Acta, v. 108, p. 184–201, doi:10.1016/j.gca.2013.01.022 [**http://dx.doi.org/10.1016/j.gca.2013.01.022**].

Richmond, B., Szczuciński, W., Chagué-Goff, C., Goto, K., Sugawara, D., Witter, R., Tappin, D.R., Jaffe, B.E., Fujino, S., Nishimura, Y., and Goff, J., 2012, Erosion, deposition and landscape change on the Sendai coastal plain, Japan, resulting from the March 11, 2011 Tohoku-oki tsunami: Sedimentary Geology, v. 282, p. 27–39, doi:10.1016/j.sedgeo.2012.08.005 [**http://dx.doi.org/10.1016/j.sedgeo.2012.08.005**].

Roy, M., Martin, J.B., Cable, J.E., and Smith, C.G., 2013, Variations of iron flux and organic carbon remineralization in a subterranean estuary caused by inter-annual variations in recharge: Geochimica et Cosmochimica Acta, v. 103, p. 301–315, doi:10.1016/j.gca.2012.10.055 [**http://dx.doi.org/10.1016/j.gca.2012.10.055**].

Sallenger, A.H., Jr., Doran, K., and Howd, P., 2012, Sea-level-rise acceleration and storm surges along the U.S. northeast coast [abs.]: Association of American Geographers Annual Meeting, New York, N.Y., February 24–28, 2012 [**http://meridian.aag.org/callforpapers/program/AbstractDetail.cfm?AbstractID=42369**].

Smith, C.G., and Marot, M.E., 2013, Preliminary analysis of back-barrier sedimentation on the Chandeleur Islands, Louisiana, following the construction of the oil-mitigation-sand berm [abs.]: Association for the Sciences of Limnology and Oceanography (ASLO) Aquatic Sciences Meeting, New Orleans, La., February 17–22, 2013 [**http://www.sgmeet.com/aslo/neworleans2013/viewabstract2.asp?AbstractID=11300**].

Storlazzi, C.D., Fregoso, T.A., Figurski, J.D., Freiwald, J., Lonhart, S.I., and Finlayson, D.P., 2013, Burial and exhumation of temperate bedrock reefs as elucidated by repetitive high-resolution sea floor sonar surveys—spatial patterns and impacts to species' richness and diversity: Continental Shelf Research, v. 55, p. 40–51, doi:10.1016/j.csr.2013.01.013 [**http://dx.doi.org/10.1016/j.csr.2013.01.013**].

Strona, G., and Lafferty, K.D., 2013, Predicting what helminth parasites a fish species should have using Parasite Co-occurrence Modeler (PaCo): Journal of Parasitology, v. 99, no. 1, p. 6–10, doi:10.1645/GE-3147.1 [**http://dx.doi.org/10.1645/GE-3147.1**].

Takekawa, J.Y., Woo, I., Gardiner, R., Casazza, M., Ackerman, J.T., Nur, N., Liu, L., and Spautz, H., 2011, Avian communities in tidal salt marshes

(Recently Published continued on page 14)

(Recently Published continued from page 13)

of San Francisco Bay—A review of functional groups by foraging guild and habitat association, *in* Ferner, M.C., ed., A profile of the San Francisco Bay National Estuarine Research Reserve: San Francisco, Calif., San Francisco Bay National Estuarine Research Reserve, p. 250–281 [**http://nerrs.noaa.gov/Doc/PDF/Reserve/SFB_SiteProfile.pdf**].

Takekawa, J.Y., Woo, I., Thorne, K.M., Buffington, K.J., Nur, N., Casazza, M.L., and Ackerman, J.T., 2012, Bird communities—effects of fragmentation, disturbance, and sea level rise on population viability, *in* Palaima, A., ed., Ecology, conservation, and restoration of tidal marshes—the San Francisco estuary: Berkeley, University of California Press, p. 175–194 [**http://www.ucpress.edu/book.php?isbn=9780520274297**].

van der Wegen, M., and Jaffe, B.E., 2013, Towards a probabilistic assessment of process-based, morphodynamic models: Coastal Engineering, v. 75, p. 52–63, doi:10.1016/j.coastaleng.2013.01.009 [**http://dx.doi.org/10.1016/j.coastaleng.2013.01.009**].

Watt, S., Buckley, M., and Jaffe, B., 2012, Inland fields of dispersed cobbles and boulders as evidence for a tsunami on Anegada, British Virgin Islands: Natural Hazards, v. 63, no. 1, p. 119–131. doi:10.1007/s11069-011-9848-y [**http://dx.doi.org/10.1007/s11069-011-9848-y**].

Wilson, R.I., Davenport, C., and Jaffe, B., 2012, Sediment scour and deposition within harbors in California (USA), caused by the March 11, 2011 Tohoku-oki tsunami: Sedimentary Geology, v. 282, p. 228–240, doi:10.1016/j.sedgeo.2012.06.001 [**http://dx.doi.org/10.1016/j.sedgeo.2012.06.001**].

Witter, R.C., Jaffe, B.E., Zhang, Y., and Priest, G., 2012, Reconstructing hydrodynamic flow parameters of the 1700 tsunami at Cannon Beach, Oregon, USA: Natural Hazards, v. 63, no. 1, p. 223–240, doi:10.1007/s11069-011-9912-7 [**http://dx.doi.org/10.1007/s11069-011-9912-7**]. ❆

Publications Submitted for Bureau Approval

Barnard, P., Erikson, L., Foxgrover, A., O'Neill, A., and Hapke, C., The application of the Coastal Storm Modeling System (CoSMoS) in assessing the vulnerability of the California coast to climate change using global climate models [abs.]: Headwaters to Ocean Conference, 11th, San Diego, Calif., May 28–30, 2013.

Brothers, L.L., Van Dover, C.L., German, C.R., Kaiser, C.L., Yoerger, D.R., Ruppel, C.D., Lobecker, E., Skarke, A.D., and Wagner, J.K.S., Evidence for extensive methane venting on the southeastern U.S. Atlantic margin: Geology.

Erikson, L., Hegermiller, C., and Barnard, P., 21st-century wave climate along the California coast [abs.]: Headwaters to Ocean Conference, 11th, San Diego, Calif., May 28–30, 2013.

Ganju, N.K., Kirwan, M.L., Dickhudt, P.J., Guntenspergen, G.R., and Cahoon, D.R., Accretion rate and sediment availability not predictive of wetland response to sea-level rise: Geology.

Griffin, D.W., The quest for extraterrestrial life—What about the viruses?: Astrobiology.

Hapke, C.J., Adams, P., Ashton, A., Griggs, G., Hampton, M., Kelly, J., and Young, A., Sea cliffs of the continental USA coast, *in* Kennedy, D., and Stevenson, W., eds., Rocky coast geomorphology—A global synthesis: Geological Society of London Memoir.

Henkel, H., USGS Science Data Coordinator Network [abs.]: The National Map 2013 Users Conference and USGS Community for Data Integration (CDI) Workshop, Denver, Colo., May 21–24, 2013.

Henkel, H., Hutchison, V., Chang, M., Faust, T., and Zolly, L., The USGS data management website [abs.]: The National Map 2013 Users Conference and USGS Community for Data Integration (CDI) Workshop, Denver, Colo., May 21–24, 2013.

Kellogg, C.A., Gray, M.A., and Galkiewicz, J.P., Identifying the core microbiome of the cold-water coral *Lophelia pertusa* [abs.]: American Society for Microbiology General Meeting, 113th, Denver, Colo., May 18–21, 2013.

Margolin, A.R., Robinson, L.F., Burke, A., Waller, R.G., Scanlon, K.M., Roberts, M.L., Auro, M.E., and van de Flierdt, T., Deep-sea coral paleo-biogeography in the Drake Passage: Deep-Sea Research.

Morgan, K.L.M., Wertz, R.R., Cross, V.A., McCloskey, B., Degnan, C., Gittens, J., and Faust, T., A use case for coastal imagery to further data integration [abs.]: The National Map 2013 Users Conference and USGS Community for Data Integration (CDI) Workshop, Denver, Colo., May 21–24, 2013.

Pe'eri, S., McLeod, A., Lavoie, P., Ackerman, S., and Gardner, J., Field calibration and validation of remote sensing surveys: International Journal of Remote Sensing.

Prouty, N.G., Goodkin, N.F., Lamborga, C.H., Jones, R., Hughen, K.A., and Storlazzi, C.D., Environmental assessment of metal exposure to corals living in Castle Harbour, Bermuda: Marine Pollution Bulletin.

Prouty, N.G., Roark, E.B., Andrews, A., Robinson, L., Hill, T., Sherwood, O., Williams, B., Guilderson, T., and Fallon, S., Age, growth rates, and paleoclimate studies, *in* Etnoyer P.J., and Hourigan T.F., eds., The state of deep coral ecosystems of the United States: NOAA Technical Memorandum CRCP, Silver Spring, Md.

Robbins, L.L., Wynn, J.G., Knorr, P.O., Lisle, J., Byrne, R.H., Takahashi, T., Onac, B.P., Yates, K.K., Azetsu-Scott, K., Liu, X., and Patsavas, M.C., Comparison of aragonite saturation states, air-sea CO_2 fluxes, and relation to sea-ice cover in different ecosystems in the Canada Basin [abs.]: Arctic Ocean Acidification International Conference, Bergen, Norway, May 6–8, 2013.

Sanders, R., A new approach to USGS data management [abs.]: The National Map 2013 Users Conference and USGS

(Publications Submitted continued on page 15)

(Publications Submitted continued from page 14)

Community for Data Integration (CDI) Workshop, Denver, Colo., May 21–24, 2013.

Sanders, R., Just enough data management, and other lessons learned by talking to research scientists [abs.]: The National Map 2013 Users Conference and USGS Community for Data Integration (CDI) Workshop, Denver, Colo., May 21–24, 2013.

Stern, R.J., Scholl, D., Scheirer, D., and Barth, G., Using scientific ocean drilling to understand the age and origin of the Aleutian Basin, Bering Sea [extended abs.]: CHIKYU+10 International Workshop, Tokyo, Japan, April 21–23, 2013.

Westrich, J.R., Griffin, D.W., and Lipp, E.K., Iron in the wind, microbes in the water—Effect of Saharan dust on *Vibrio* growth [abs.]: American Society for Microbiology General Meeting, 113th, Denver, Colo., May 18–21, 2013.

Wynn, J.G., Robbins, L.L., Knorr, P.O., Yates, K.K., Lisle, J., Byrne, R.H., Liu, X., Patsavas, M.C., Onac, B.P. Azetsu-Scott, K., and Takahashi, T., Rapid sea-ice loss and aragonite undersaturation in the western Arctic: Responses of Arctic Marine Ecosystems to Climate Change, Lowell Wakefield Fisheries Symposium, 28th, Anchorage, Alaska, March 26–29, 2013, proceedings. ☸

Sound Waves
U.S. Geological Survey
400 Natural Bridges Drive
Santa Cruz, CA 95060